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Fine-Structures of the Normal and Rheumatoid Synovial Membrane —with Special Reference to the Acid Mucopolysaccharide Localization in the Lining Cells—

by

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I. INTRODUCTION

As to the fine-structure of the synovial membrane in normal human and animals, the following investigators have already related their observations: LEVER and FORD (1958), HIROHATA et al (1958, 1963), LANGER and HUTH (1960, 1965), SHIBATA and KAWASAKI (1961), BARLAND, NOVIKOFF and HAMERMAN (1962), COTTA and DETTMER (1962) and COULTER (1962).

Among them, BARLAND and NOVIKOFF (1962, 1964), who reported relatively precise observation, mentioned the presence of two types of the lining cells at the surface of the synovial membrane, that is, type A and type B cells. According to their observation, type A cell showed many filopodia and numerous vacuoles, whereas type B cell showed large amounts of ergastoplasm. These findings suggested that the function of type A cell is related to the phagocytosis of the substances in the articular fluid and the function of type B cell to the synthesis of protein. However, the fine-structure of the synovial lining cells is so complicated that there are still many different opinions, and the author has not yet obtained so far a unanimous opinion.

In connection with the fine-structural changes of the synovial lining cells of the patients with chronic rheumatoid arthritis (hereinafter abbreviated as RA), those investigators including BARLAND, NOVIKOFF and HAMERMAN (1961, 1964), SHIOKAWA (1963), NORTON and ZIFF (1964, 1966) and HIROHATA et al (1965) have already made observations. For example, BARLAND et al (1961, 1964) stated that type A cells had shown increased number of vacuoles and many complex cytoplasmic granules showing remarkable acid phosphatase activity, whereas they did not observe any remarkable structural changes in type B cells as compared with normal.

On the other hand, HIROHATA et al (1965) observed increased M cells showing multiple cytoplasmic processes and vacuoles, and in whose cytoplasm a variety of electron dense granules having boundary membranes was reported. They also observed that F

cells rich in rough surfaced endoplasmic reticulum had shown remarkable development of Golgi apparatus and saccular enlargement of rough surfaced endoplasmic reticulum as compared with normal. Recently, NORTON and ZIFF (1966) reported that intermediate cells between the type A and type B cells were frequently observed in the rheumatoid synovial lining. These cells showed a capacity for phagocytosis as already observed in type A cells. However, as far as the electron microscopic observation of the synovial lining cells in RA is concerned, there have been only a few reports published so far.

The author has performed a comparative electron microscopic observation of the normal and inflamed synovial lining cells of patients with RA in order to clarify their fine-structural changes.

As to the problem of the localization of acid mucopolysaccharides (hereinafter abbreviated as MPS) in the synovial lining cells, CASTOR (1960) certified the positive staining of normal human synovial lining cells with alcian blue (pH 5.0). BLAN, JANIS, HAMERMAN and SANDSON (1965) observed the presence of MPS in both the synovial lining cells and the intercellular ground substance by immuno-fluorescent methods.

By electron microscopic observation of the dog synovial lining cells after the intra-articular injection of alcian blue (pH 2.5) using the living animals, OHKURA (1966) reported the presence of the alcianophilic dense aggregates in the synovial lining cells and the intercellular substance.

In the present study, the author tried to investigate on changes of the localization of MPS in the normal and in the synovial membrane of patients with RA.

II. MATERIAL AND METHODS

As the author had difficulty in obtaining a normal human synovial membrane, the materials were taken from the medial portion of the supra-patellar pouch of the knee joints during the surgical operations of 3 cases with fresh patellar fracture. Additional material was taken from the same portion of 1 case of the patient with low back pain who showed no abnormalities in the knee joint. All the four materials revealed no pathological changes including inflammation by light microscopic observations. The pathological materials were taken from 12 cases who had been given the diagnosis of RA on the bases of the inflammatory symptoms and the serological reactions. The total of 15 knee joints of the 12 cases were used to obtain the materials from the medial side of the supra-patellar pouch of the knee joints using open biopsy and POLLY's punch-method.

The materials were fixed in 2% glutaraldehyde in phosphate buffer (pH 7.3) at 4° C for 2 hours. Then, the materials were washed in 0.05 M MCILVAINE buffer solution (pH 2.5) containing 45 mg/ml sucrose and stained with alcian blue for 5 minutes: The staining solution of 0.3% alcian blue was prepared by using the same buffer of pH 2.5. After the staining of the tissue slices, they were washed in the same buffer for 5 minutes and refixed in 2% phosphate buffered glutaraldehyde. Before embedding, the materials were postosmicated in 1% osmium tetroxide (ZETTERQVIST), and then embedded in Epon 812 by TAKASIO's method (1963).

The control materials were processed in the same method except for that they were treated with the pH 2.5 citric acid-phosphate buffer without alcian blue.

The ultrathin sections of the material histochemically treated were not stained with

any electron dyes and sections were observed in a HITACHI Electron microscope HU 11-A. In order to clarify the nature of the alcian blue positive material, the following study was performed : the slices of the synovial membrane were incubated in a testicular hyaluronidase solution (pH 6.0) for 4 hours at 30°C and then stained with the alcian blue solution (pH 2.5) and finally observed under the light microscope.

III. RESULTS AND DISCUSSION

1. The normal human synovial lining cells.

LEVER and FORD (1958) reported the defect of the synovial lining cells, whereas LANGER and HUTH (1960) reported, rare cases of the lining of the remarkably closely arranged synovial cells.

In our own materials, the surface of the synovial membrane was occasionally loosely covered with the synovial lining cells ; however, in most cases, the intercellular amorphous matrix of the synovium was exposed to the intra-articular cavity. The synovial lining cells are separated by wide intercellular spaces, as observed by LEVER et al (1958) and BARLAND et al (1962) (Fig. 1). We could classify the human synovial lining cells into 2 types, type A and type B cells, as BARLAND et al (1961, 1962) already pointed out. Type A cells were generally located on the superficial layer of the synovial membrane and showed multiple finger-like processes which were various in size and which often surrounded amorphous substance (Figs. 1 and 2). The cytoplasm showed many vacuoles (0.2 μ to 1.6 μ in diameter) which were distributed throughout the entire cytoplasm. Most of the vacuoles contained the amorphous substance being mostly attached to the inner surface of the limiting membrane of vacuoles (Fig. 2). On rare occasion the rough surfaced endoplasmic reticula were observed in cells of this type. However, we observed relatively many granules of the ribonucleic protein throughout the entire cytoplasm. Though BARLAND et al (1962) observed well-developed Golgi apparatus, these organelles were few in our own materials. Type A cell rather resembled M cells reported by HIROHATA et al (1963). The mitochondria of round or elongated elliptical shape were scattered throughout the entire cytoplasm, and the intercristal matrix was relatively electron dense. The nucleus was elongated elliptical in shape and showed frequently depressions on

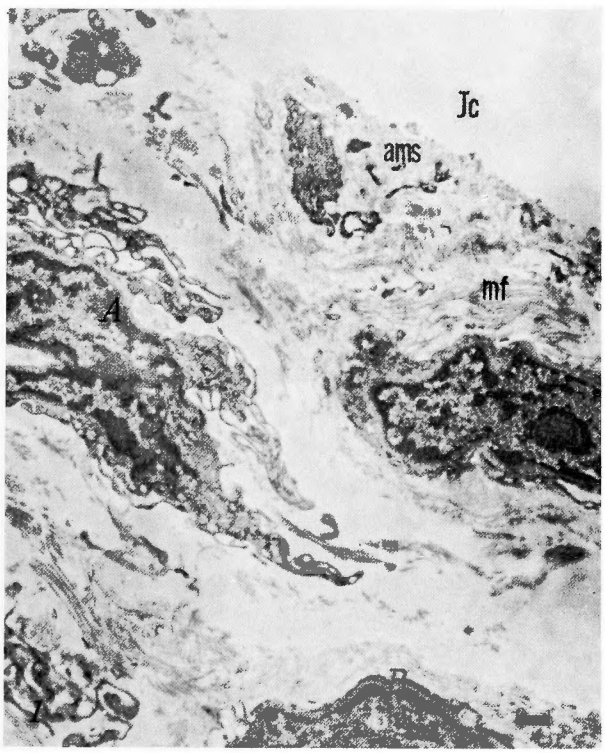

Fig. 1 Overall view of a normal human synovial membrane. At the top is the joint cavity (Jc). ×6,500

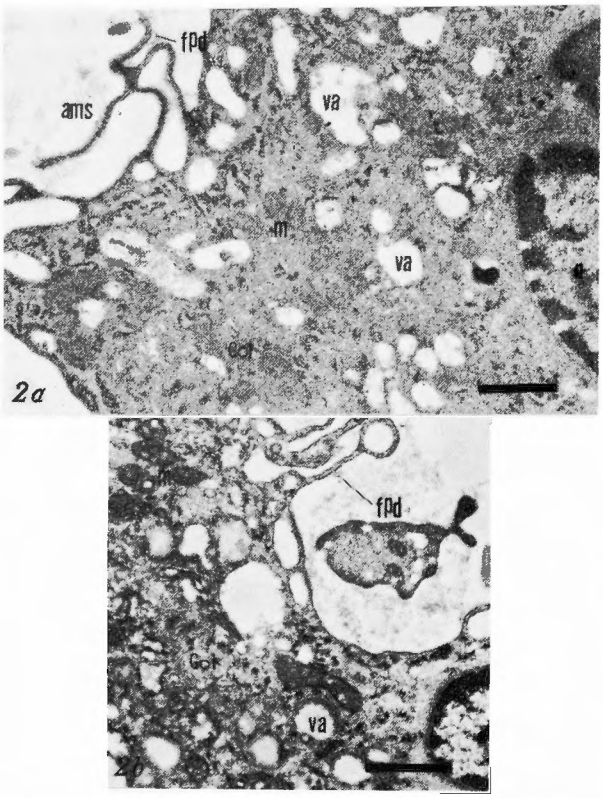

Fig. 2a Type A lining cell from a normal synovial membrane. ×18,000
Fig. 2b Type A cell. ×20,000

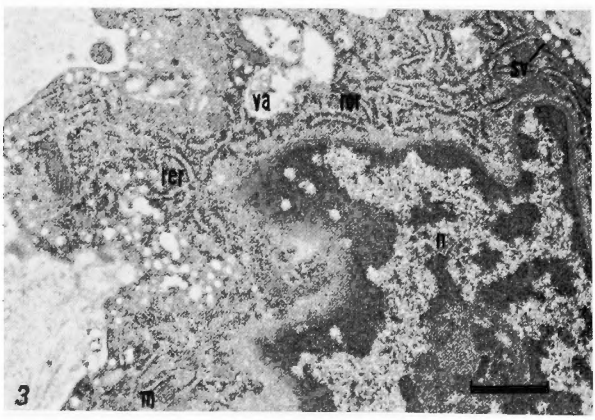

Fig. 3 Type B lining cell from a normal synovial membrane. ×18,000

the surface (Figs. 1 and 2). Type A cells revealed in most cases electron dense cytoplasmic ground substance (Fig. 2 a), but some of them showed relatively electron-lucent cytoplasm (Fig. 2 b). The latter type resembled type A in animal synovial cells which OHKURA (1966) reported. Concerning the often encountered vacuoles in the type A cells, MUIRDEN and ARBOR (1963), BALL, CHAPMAN and MUIRDEN (1964) and COCHRANE, DAVIES and PALFREY (1965) mentioned that they were related to the intake and breakdown of materials and were, at the same time, related to the metabolism of the articular fluid. On the other hand, LANGER and HUTH (1965) considered that type A cells were similar to the histiocytes in shape and regarded them as phagocytic cell.

Type B cells showed usually short, small and tongue shaped processes. In the type B cells, well-developed rough surfaced endoplasmic reticula are observed showing saccular enlargement occasionally (Fig. 3). Although vacuoles (200 mμ to 600 mμ) were observed between the endoplasmic reticula, they were remarkable less in number compared to that of type A cell. There were many vesicles in the ectoplasm of type B cells, and they appeared to be in contact with the cellular membrane. These vesicles were probably related to the pinocytosis. Golgi's apparatus was relatively rich in number compared to type A cells. The mitochondria of smaller size were much more numerous than those in the type A cells. As to the nuclear structures, no remarkable difference from those of type A cells was noted.

As mentioned above, the characteristics of type B cells consisted of richly present

rough surfaced endoplasmic reticulum and Golgi's apparatus. In our preparations type B cells were similar to type B cells reported by BARLAND et al (1962) and to F cells of HIROHATA et al (1963). However, HIROHATA et al did not observe the presence of vacuoles in F cells which makes some difference from the author's observation of type B cells. In any event, it is a clear fact that those cells showed rich amount of rough surfaced endoplasmic reticula, and it is probable that those cells are closely related to the protein synthesis.

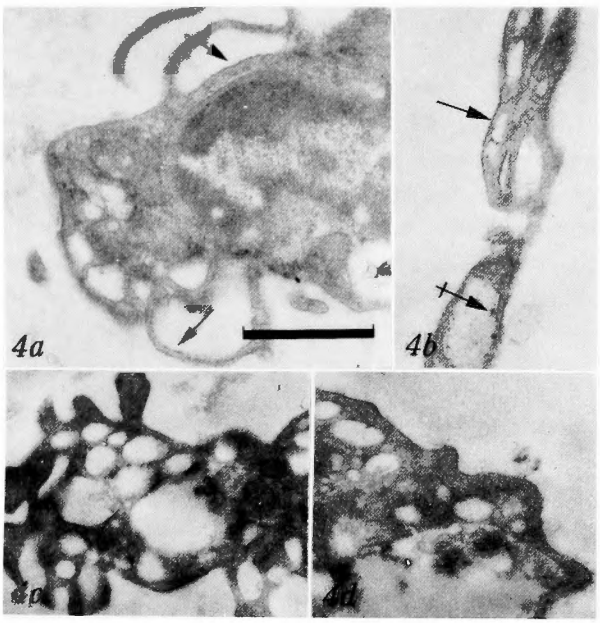

Fig. 4a, 4b Part of normal type A cell stained with an alcian blue solution of pH 2.5. ↑ indicates electron opaque deposits on the surface of plasma membrane. ×27,000

Fig. 4c Control preparation. Stained with the same solution only lacking alcian blue. No electron dense deposits are found on the cell surface. ×24,000

Fig. 4d Control preparation. Treated with hyaluronidase. ×27,000

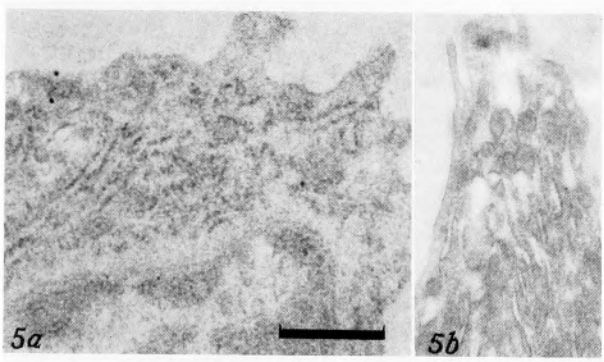

Fig. 5a Part of normal type B cell stained with an alcian blue. No electron opaque deposits. ×23,000

Fig. 5b Control preparation. ×23,000

In order to observe the MPS localization in the synovial membrane, the synovial membrane was stained with alcian blue, and light microscopical procedure found that the synovial lining cells and the intercellular ground substance were stained moderately. Electron microscopic images of the same stained specimen revealed the electron opaque deposits of about 15 mμ in thickness on the surface of plasma membrane of type A cells surrounding the articular cavity (Fig. 4 a and b ↑), and these deposits are thought to be formed by the interaction between alcian blue and MPS. Occasionally, there were some electron dense granular aggregates of about 50 mμ in diameter (Fig. 4 b ↑) within the vacuoles. The electron opaque deposits of about 10 mμ in thickness were also observed on the surface of the plasma membrane of the lining cells (type A). However, the same electron dense deposits were not visualized clearly in connection with those type A cells which were more deeply located. The author did not identify the presence of the electron dense deposits in the intercellular amorphous substance, though OHKURA (1966) reported the presence of electron dense deposits in the amorphous substance of the intravitally

stained synovial membrane. In the control material which was stained with the same solution only lacking alcian blue, the plasma membrane of the synovial lining cells did not show any increased contrast observed in the material stained with alcian blue (Fig. 4 c). Similar findings were verified in the material which was treated with hyaluronidase (Fig. 4 d). On the contrary to type A cells, no such electron opaque deposits were visible in any intracytoplasmic components on the surface of type B cells (Fig. 5).

2. The synovial lining cells of the patients with chronic rheumatoid arthritis.

The light microscopic observation of the synovial lining cells of the RA patient was already performed by SOKOLOFF (1951), KODAMA (1953) and GEILER (1963). The author observed similar findings such as thickening and proliferation of the synovial lining cells, cellular infiltration of plasma cells and lymphocytes in the synovial membrane. The superficial layer of RA synovial membrane revealed almost complete absence of the relatively smooth layer of the amorphous substance which was observed in the normal. Synovial lining cells from RA patients were of irregularly round, polygonal, flat or kidney shape, showing extremely rich cytoplasmic processes, but some of them revealed scanty cytoplasmic processes. In RA patients, obviously synovial lining cells increased in number, and more densely arranged ones compared with the normal cases were observed (Fig. 6). The type A cells of RA patients were generally large in size, and most of the cells exposed to the articular cavity were type A cells which showed the finger-like processes and intermingled with the neighbouring cells (Fig. 6). Amorphous substance was sometimes surrounded by the finger-like processes of type A cell (Fig. 6 ↑).

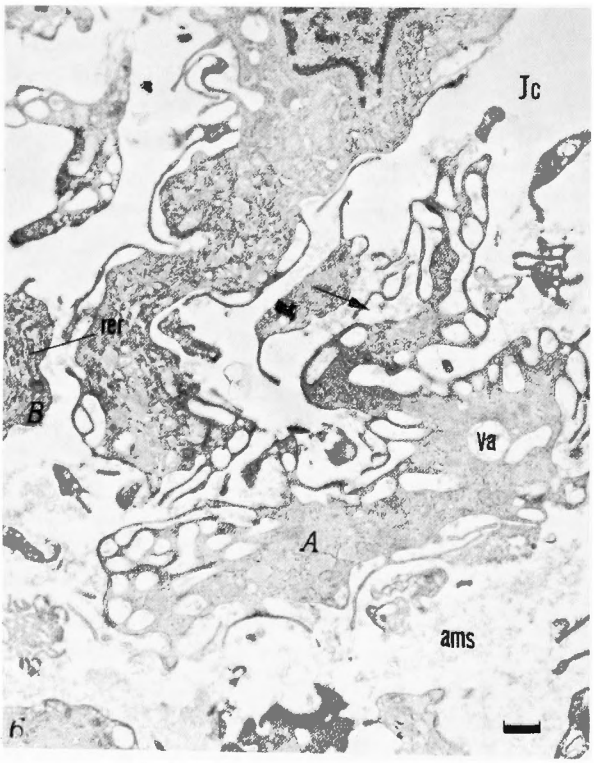

Fig. 6 Overall view of rheumatoid synovial membrane. At the top is the joint cavity (Jc) ×8,000

The vacuoles (0.2 μ to 1 μ) in the cytoplasm were round, elongated elliptical and poly-hedral in shape and surrounded by the limiting membranes of approximately 4 mμ in thickness (Figs. 7 a, 7 b). However, the vacuoles in type A cells of RA were numerous and smaller in size than normal cells, and they contain relatively homogeneous electron densed amorphous substance. Sometimes we encountered in the synovial lining cells from the RA patients dense granules (Figs. 7 and 8 Lg), which were similar to those reported by DUVE et al (1955), BARLAND et al (1964) as lysosome, or mentioned by KAJIKAWA et al (1960) and YAMORI et al (1962) as special granules. (A large dense

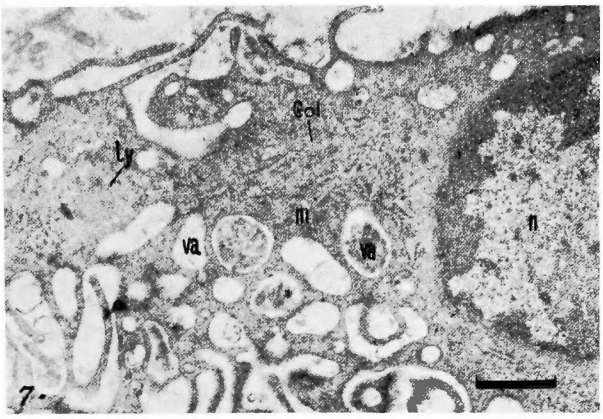

Fig. 7 Type A lining cell from the rheumatoid synovial membrane. ×18,000

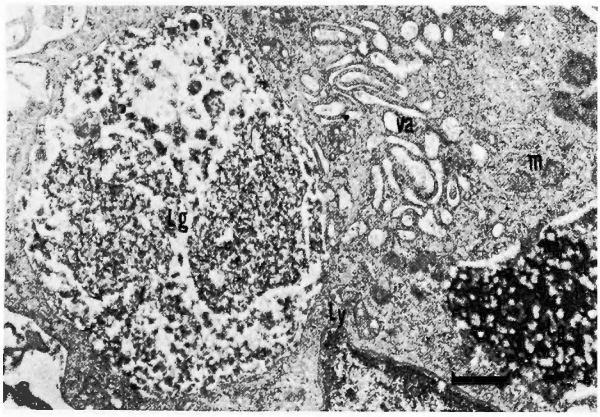

Fig. 8 Portion of the rheumatoid type A cell. A large dense cytoplasmic inclusions are evident. ×13,000

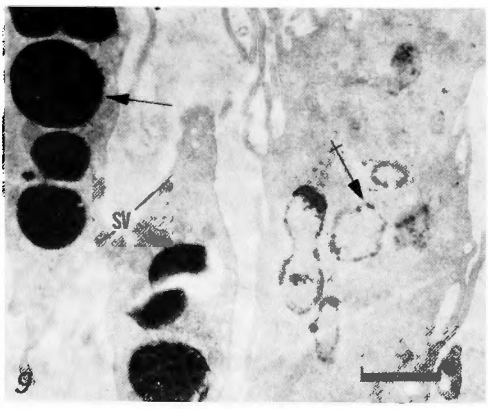

Fig. 9 Rheumatoid type A cells showed fat droplets ×17,000

cytoplasmic inclusions (about 3 to 7 μ) can be seen in Fig. 8). These granules resembled the acid phosphatase positive complex cytoplasmic granules which were observed by BARLAND et al (1964) in the type A cells of the synovial membrane of RA, though these granules differ from Barland's findings in that they did not show any "membranous whorls" or "membrane-bound vacuolated structure". These granules would probably contain the undigested remaining particles which are produced in the process of phagocytosis of various destructed material during the inflammatory process of RA. The Golgi's apparatus and the rough surfaced endoplasmic reticula were poorly developed in type A cells of RA just as in the normal (Fig. 7). Mitochondria were swollen and contained obscure cristae (Figs. 7 and 8). Some of the type A cells showed large or smaller fat droplets (Fig. 9 ↑).

In case of RA, type B cells were located slightly deeper than type A cells as in normal materials. However, rough surfaced endoplasmic reticula increased much more in RA synovium, and they showed tubular or saccular enlargement (Fig. 10). As to Golgi's apparatus, it was more centrally located in the cells than in a normal cell. Golgi's vesicles were enlarged to be globular or deformed to be plate shaped (Fig. 10).

In the superficial layer of the synovial membranes of RA, the infiltration of plasma cells was found. The fine-structure of these plasma cells was similar to that already pointed out by HIROHATA et al (1965), which had elliptical and irregular shape with few cytoplasmic processes. In the cytoplasm, there was extremely rich amount of rough surfaced

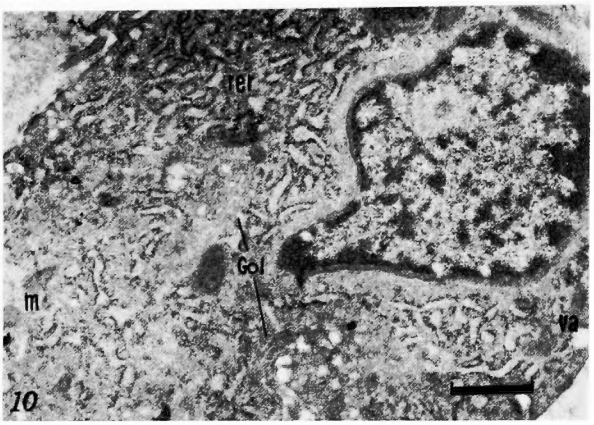

Fig. 10 Type B lining cell from the rheumatoid synovial membrane. ×18,000

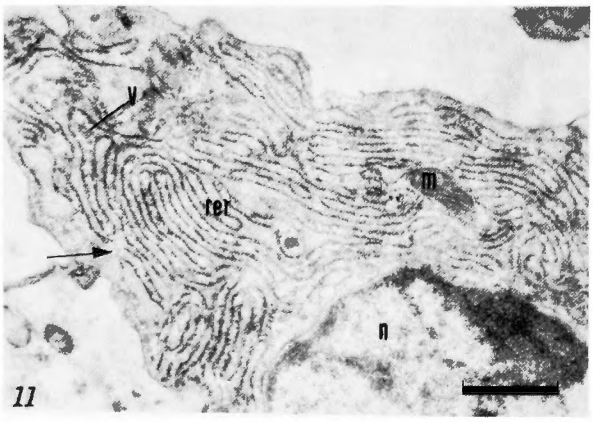

Fig. 11 Plasma cell in the rheumatoid synovial membrane. ×21,000

endoplasmic reticula. Some of the endoplasmic reticula were enlarged containing relatively electron dense substance (Fig. 11). Some of the endoplasmic reticula were devoid of the limiting membrane. Golgi's apparatus was also well developed, and the round or elongated elliptical shaped mitochondria were relatively few. Some of the mitochondria showed obscure cristae containing small vesicular substance. The nucleus was generally oval in shape with few cases showing indentation.

In alcian blue preparation, strongly blueish stained substance was observed in both intercellular ground substance and the ground cytoplasm of the proliferated lining cells as compared with normal human materials. Alcianophilic staining decreased gradually as it goes down deeper from the surface of synovial membrane. BURKL and SONNENSCHEIN (1952) observed similar findings by using toluidin blue metachromasia and again YOSHINO and NAKAJIMA et al (1961) using PAS staining. In the material treated with hyaluronidase, alcian blue was weakly positive both in intercellular ground substance of the most superficial layer of the synovial membrance and the lining cells.

Electron microscopic observation of the same material revealed that electron opaque deposits of approximately 50 mμ in thickness were attached on the surface of the plasma membranes of the type A cells surrounding the articular cavity (Fig. 12 a ↑). The above mentioned type A cells showed often electron dense deposits of approximately 15 mμ in thickness (Fig. 12 a ↑) on the limiting membrane of the vacuole close to the plasma membranes. Type A cells deeply located showed the electron dense deposits of approximately 20 mμ in thickness attached on the surface of the plasma membrane, although the staining reaction was slightly weak.

In the control material which had not been stained with alcian blue, no electron opaque deposits could be found on the surface of the plasma membrane of type A cells (Fig. 12 b). The material which was stained with alcian blue after having been treated with hyaluronidase showed only weak staining reaction of the substance in the lining cells under the light microscope. The same specimen, however, did not show any electron

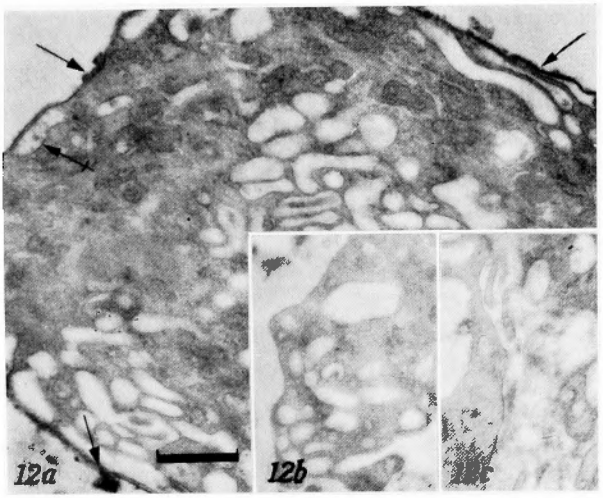

Fig. 12 a Rheumatoid type A cell stained with an alcian blue. Electron dense deposits are obviously found on the cell surface. ×18,000

Fig. 12 b Control preparation. Stained with the same solution only lacking alcian blue. ×24,000

Fig. 12 c Control preparation. Treated with hyaluronidase. ×27,000

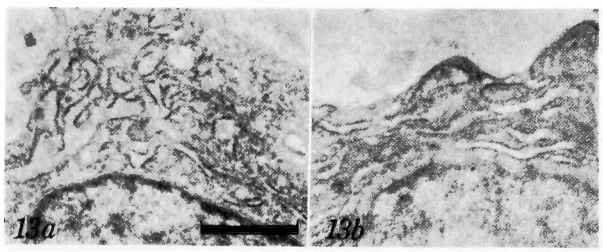

Fig. 13 a Rheumatoid type B cell stained with an alcian blue. ×21,000

Fig. 13 b Control preparation. ×21,000

dense deposits on the surface of the plasma membrane of type A cells under the electron microscope (Fig. 12 c).

We could not verify any increase of the electron microscopic contrast in the cytoplasmic component of type B cells (Fig. 13).

In RA, type A cells showed much stronger staining reaction than the normal, which suggests that the synovial lining cells, especially type A cells would possess the function of MPS synthesis and the increased amount of the depolymerized MPS in RA, as BURKL et al (1952) reported.

IV. CONCLUSION

The author made electron microscopic observation of the localization of acid mucopolysaccharide and the fine-structures of the lining cells of both normal and RA synovial membrane. Results obtained are summarized as follows.

1. On the surface of the normal synovial membrane, relatively smooth amorphous substance was observed, and the synovial lining cells were arranged loosely. The synovial lining cells were classified into 2 types on the basis of their fine-structures. Type A cells showed rich finger-like processes and vacuoles, whereas type B cells showed short tongue shaped processes and rich amount of rough surfaced endoplasmic reticula. In the normal synovial superficial layer which was stained with alcian blue, the electron opaque deposits which were considered to be due to the interaction between alcian blue and MPS were observed on the surface of the plasma membrane of type A cells. However, type B cells did not show such electron opaque deposits.

2. The surface of the synovial membrane of the patients with RA showed marked irregularity with zigzag contour; the lining cells were arranged more compact than the normal. Most of the lining cells (type A) were found to be exposed to the articular cavity and showed many or few finger-like processes, rich and complicated shapes of vacuoles.

3. Type A cells of RA often showed large granules of 3 to 7 μ in diameter which

were full of electron dense granular substance. These large granules were considered to be tissue components in a state of destruction resulting from the inflammatory process.

4. The type B cells of RA showed very often richer amount of the rough surfaced endoplasmic reticula than the normal, which to the extent of being saccular in shape. Golgi's apparatus was also well developed.

5. In the synovial membrane of RA, the infiltration of many plasma cells was observed. These plasma cells showed remarkably rich in amount the rough surfaced endoplasmic reticula.

6. In the synovial superficial layer of the patients with RA, remarkably obvious alcianophilic electron opaque deposits were proved to be present on the surface of plasma membrane and the limiting membrane of vacuoles of type A cells as compared with the normal. No such electron opaque deposits were visible in the type B cells as in the normal synovium.

7. In both normal and RA, the presence of electron opaque deposits was observed on the type A cells in the superficial layer of the synovial membrane which suggests that type A cells would be related to the production and excretion of MPS. Furthermore, the remarkable reaction of type A cells in RA suggests the productive and excretion function of MPS in type A cells.

REFERENCES

1) Ball, J., Chapman, J. A. and Muirden, K. D. : The uptake of iron in rabbit synovial tissue following intra-articular injection of iron dextran. J. Cell Biol. **22** : 351-364, 1964.
2) Barland, P., Novikoff, A. B. and Hamerman, D. : Electron microscopy of the human synovial membrane. Arth. & Rheumat. **4** : 408, 1961.
3) Barland, P., Novikoff, A. B. and Hamerman, D. : Electron microscopy of the human synovial membrane. J. Cell Biol. **14** : 207-220, 1962.
4) Barland, P., Novikoff, A. B. and Hamerman, D. : Fine structure and cytochemistry of the rheumatoid synovial membrane, with special reference to lysosomes. Amer. J. Path. **44** : 853-862, 1964.
5) Blan, S., Janus, R., Hamerman, D. and Sandson, J. : Localization of hyaluronateprotein in synovial lining cell by immunofluorescent methods Arth. & Rheumat. **8** : 432-433, 1965.
6) Burkl, W. und Sonnenschein, A. : Über Vorkommen und Verteilung der Mucopolysaccharide in der Synovialis bei Erkrankungen der Kniegelenke. Virchows Archiv. **322** . 442-451, 1952.
7) Castor, C. W. : The microscopic structure of the normal human synovial tissue. Arth. & Rheumat. **3** : 140-151, 1960.
8) Cochrane, W., Davies, D. V. and Palfrey, A. J. : Absorptive functions of the synovial membrane. Ann. Rheum. Dis. **24** : 2-15, 1965.
9) Cotta, H. und Dettmer, N. : Elektronenoptische Untersuchungen an der Gelenkkapsel und ihre Bedeutung für die Morphologisch-funktionelle Einheit des Gelenkes. Arch. Orthop. Unfall. Chir. **54** : 443-494, 1962.
10) Coulter, W. H. : The characteristics of human synovial tissue as seen with the electron microscope. Arth. & Rheumat. **5** : 70-80, 1962.
11) De Duve, C., Pressman, B. C., Gianette, R., Wattiaux, R. and Appelmans, F. : Tissue fractionation studies. 6, intracellular distribution patterns of enzymes in rat liver tissue. Biochem. J. **60** : 604-617, 1955.
12) Geiler, G. : On the evaluation and criticism of so-called collagen diseases. Z. Rheumaforsch. **22** : 117-129, 1963.
13) Hirohata, K. : Studies on the ultrathin section of the synovial tissue, with the phase contrast microscope and the electron microscope. Kobe J. Med. Science. **4** : 241-269, 1958.
14) Hirohata, K., et al. : Electron microscopic studies on the joint tissues under the normal and pathologic conditions. 1. Normal joint tissue (1st Report). J. Jap. Orthopaed. Assoc. **36** : 871-883, 1963.
15) Hirohata, K., et al. : Electron microscopic studies on the joint tissues under normal and pathologic condi-

tions. 2. pathological joint tissues (1st Report). J. Jap. Orthopaed. Assoc. **39** : 149-183, 1965.
16) Kajikawa, K. and Hirono, R. : Electron microscopic study of connective tissue cells. J. Electr. Microscop. **8** : 146-147, 1960.
17) Kodama, T. : Study of rheumatoid arthritis. J. Jap. Orthopaed. Assoc. **26** : 161-162, 1953.
18) Langer, E. und Huth, F. : Untersuchungen über den Submikroskopischen Bau der Synovialmembran. Z. Zellforsch. Mikr. Anat. **51** : 545-559, 1960.
19) Langer, E. und Huth, F. : Elektronenmikroskopische Untersuchungen der Aufnahme von Myofer durch die Synovialmembran. Beitrage zur Path. Anat. **131** : 435-449, 1965.
20) Lever, J. D. and Hord, E. H. R. : Histological, histochemical and electron microscopic observations on synovial membrane. Anat. Rec. **132** : 525-539, 1958.
21) Muirden, K. D. and Mich, A. A. : An electron microscope study of the uptake of ferritin by the synovial membrane. Arth. & Rheumat. **6** : 287, 1963.
22) Norton, W. L., Ziff, M. and Tex, D. : The ultrastructure of rheumatoid synovium and subcutaneous nodule. Arth. & Rheumat. **7** : 335, 1964.
23) Norton, W. L. and Ziff, M. : Electron microscopic observations on the rheumatoid synovial membrane. Arth. & Rheumat. **9** : 589-610, 1966.
24) Ohkura, T. : Elektronenmikroskopisch-histochemische Untersuchung der säuren Mucopolysaccharide an der Synovialmembran eines Hundes. J. Electr. Microscop. **15** : 167-178, 1966.
25) Shibata, M. and Kawasaki, M. : Electron microscopic image on cartilage and synovial membrane of the human knee joint. J. Jap. Orthop. Assoc. **35** : 1001-1002, 1961.
26) Shiokawa, Y. : Rheumatic diseases and connective tissue. (with special reference to electron microscopic study of synovial membrane). Clin. All. Round. **12** . 435-443, 1963.
27) Shiokawa, Y. : Electron microscopy of the rheumatic diseases. Jap. J. Clin. Medic. **21** : 1053-1060, 1963.
28) Sokoloff, L., Wilens, S. L. and Bunim, J. J. : Arteritis of striated muscle in rheumatoid arthritis. Am. J. Path. **27** : 157-174, 1951.
29) Takashio, M. : Technical modifications in epon embedding. J. Iwate Med. Assoc. **15** : 170, 1963.
30) Yamori, T., Mori, Y., Sasaki, M. and Matsuura, S. : Electron microscopic observation of the reticuloendothelial system. The Saishin-Igaku. **17** : 1022-1032, 1962.
31) Yoshino, R. et al. : Histochemical study on synovial membrane of chronic arthritis. (2nd Report). J. Jap. Orthopaed. Assoc. **36** : 732-733, 1962.

和文抄録

健常人並びに慢性関節リウマチにおける滑膜表層細胞の微細構造および酸性ムコ多糖類の局在に関する電子鏡的観察

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健常人および慢性関節リウマチ患者の滑膜表層細胞の微細構造と酸性ムコ多糖類の局在を電子鏡下に観察し，その変化について検索した．

実験材料は，4例の健常人膝関節と12例の慢性関節リウマチ患者の15膝関節の膝蓋上嚢内側部より採取した．採取した組織片は，2% glutar aldehyde で固定し，alcian blue 溶液（pH 2.5）で染色した後，1%四酸化オスミウム後固定した．

健常人滑膜表面は，概して比較的平滑な無定形物質が関節腔に露出しており，滑膜表層細胞は無定形物質を介して，疎に配列している．

滑膜表層細胞は，その微細構造から2種に大別出来た．すなわち，A型細胞は，豊富な指状突起と液胞を有し，B型細胞は，短小な舌状突起と多くの粗面小胞体を有している。

慢性関節リウマチ患者の滑膜表面は，極めて凸凹不正となり，滑膜表層細胞は，健常に比し密に配列し，大部分は関節腔に露出して観察され，その多くは，A型細胞である．

慢性関節リウマチのA型細胞の構造は，極めて多彩であるが，一般に，指状突起がより豊富で，多様な液胞を多く有する．また，電子密な粒状物質を充満させている径3～7μの大粒子を有するA型細胞も観察された．この大粒子は，炎症過程で生ずる組織破壊産物と推測される．円形，楕円形の糸粒体は，健常のものに比して膨化し，架板は不明瞭である．

慢性関節リウマチのB型細胞は，しばしば粗面小胞体が，健常のものより豊富となり，また，拡大して嚢胞状を呈し，Golgi 体も粗面小胞体の増加に伴い多く観察された．

慢性関節リウマチの滑膜表層には，また，粗面小胞体と Golgi 体が極めて豊富で，よく発達した多くの形質細胞の出現を観察した．

alcian blue で染色した健常人滑膜を電子鏡下で観察すると，滑膜表層A型細胞の形質膜表面に，alcian blue と酸性ムコ多糖類との結合に由来したと見られる層状濃影の物質が沈着しているのが見られた．しかし，B型細胞では，これらの被染物と見られる物質は，観察されなかった．

慢性関節リウマチ患者の滑膜表層では，やはり，A型細胞の形質膜表面に被染物を証明したが，それは健常のものより著明に観察された．病的A型細胞では，時に，液胞の境界膜にも被染物が観察された．B型細胞では，健常人滑膜と同様に，かかる被染物は検出されなかつた．

以上の如く，健常でも，慢性関節リウマチの場合でも，滑膜表層のA型細胞に被染物を見ることから，A型細胞は，酸性ムコ多種類の分泌合成に大いに関係を有しているものと想像される．そして慢性関節リウマチにおけるA型細胞の著明な反応は，A型細胞の酸性ムコ多糖類分泌合成機能を更に暗示するものであり，また，酸性ムコ多糖類の分泌合成機能が健常時より亢進しているものと推測される．